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SUGGESTIONS FOR BOLL WEEVIL POISONING BASED ON 1919 STUDIES

By B. R. Coad and T. P. Cassidy.

The literature on the boll weevil poisoning investigations of the Department of Agriculture has become out of date and as more recent investigations have given reason for slightly changing the plans and recommendations, the present circular is designed to give a very brief digest of the poisoning practices which seem best justified as a result of the experiments to date. This circular will, of course, be followed by a more detailed publication on the subject but is intended to answer the needs of the individual contemplating poisoning until the bulletin on this subject is ready for distribution. Anyone desiring more complete information is invited to correspond with the Delta Laboratory, Tallulah, La.

PRINCIPLES GOVERNING POISONING OPERATION

It should be understood at the outset that the present system of boll weevil poisoning is not intended to eradicate the weevil. It is purely a percentage proposition and the best that can be hoped under present methods of operation is to reduce the weevils sufficiently to permit the maturing of a full crop of cotton. The normal shed of the cotton fruit without weevil injury is so great that a certain amount of weevil feeding can be experienced before any actual reduction in crop yield results. Consequently, the one basic idea of the poisoning is to merely keep the weevils sufficiently reduced in numbers so that their feeding will not overtake the fruit shed which would be experienced in their absence. This naturally means that to secure the most profitable results, the weevils are allowed to develop unmolested until they approach the point of actually reducing the crop and they are then held in check by poisoning just long enough to let the plants set and develop beyond weevil injury all bolls they will be able to mature. Then poinoning is stopped and the weevils allowed to resume multiplying.

It should also be remembered that poisoning affects only the adult or beetle stage of the weevil and does not affect the larval or grub stage which is within the cotton square or boll during the poisoning operation. Because of this fact, the effect of poison is practically always cumulative and it is very seldom that the desired results can be secured from a single application. Once poisoning is started it must be continued at the proper interval, or the chances are very great indeed that the entire operation will be a failure.

The results in 1919 were such that it seems quite probable that weevil poisoning can be adapted to almost any conditions found in the seriously injured areas, but it must be remembered that poisoning is so dependent on many local conditions that it is decidedly advisable for everyone to "go slow" in their initial efforts and to undertake only as much poisoning as they can thoroughly supervise. In other words, it will undoubtedly be far better to attempt only a comparatively few acres which are carefully poisoned rather than a larger acreage improperly handled. The writers also wish to suggest that check plats be arranged whenever possible. To do this, one or more uniform cuts of cotton should be selected and divided in half so that one portion can be poisoned and the remainder retained as a check. No poison whatever should be applied to the check plat. These plats should be arranged so as to secure as acccurate a comparison as possible in order to afford an opportunity of determining the exact results of the operation. This, of course, may mean some loss of cotton which might have been saved by poisoning, but, on the other hand, the value of the information secured will be far greater than that of the lost cotton.

POISON TO USE

The chemical now recommended for this work is calcium arsenate applied in the form of a dry powder or dust. This should be used straight without the addition of lime or any other carrier.

POISON SPECIFICATIONS REQUIRED

Because of the danger of securing an improperly manufactured calcium arsenate, everyone is advised to purchase material guaranteed to conform to the following specifications:

Not less than 40% Arsenic Pentoxide
" more " 0.75% Water Soluble Arsenic Pentoxide
Density not less than 80 pr more than 100 cubic inches per pound.

If the material meets these specifications, it will be in the most satisfactory condition for dusting and will be perfectly safe to use. Everyone purchasing calcium arsenate for cotton dusting is advised to send samples to Talullah, for free analysis in order to determine if it is satisfactory for use. Complete instructions for preparing these samples may be secured on application to the Delta Laboratory.

KEEPING QUALITTIES OF CALCIUM ARSENATE

A properly made calcium arsenate will keep indefinitely without deterioration if stored in a reasonably dry place.

SUPPLY OF CALCIUM ARSENATE AND DUSTING MACHINERY AVAILABLE

In spite of the fact that calcium arsenate is a comparatively new product, a large number of manufacturers are now interested in its production and the present prospects are that the supply of calcium arsenate this year will be in excess of the supply of suitable dusting machinery, As satisfactory results cannot be secured without the proper machinery, everyone is advised to locate machines before purchasing calcium arsenate.

EFFECT OF THE POISON ON MAN AND ANIMALS

The use of calcium arsenate is not nearly as dangerous as was the case with Paris green, since it does not possess the caustic characteristics of the latter, but is undoubtedly attended with a certain amount of danger, Hence reasonable precaution should be taken to prevent swallowing the material and also to reduce as much as possible the amount inhaled with the breath. Absorption through the skin also frequently takes place and excessive contact with the poison should be avoided. This danger can, of course be reduced by fairly frequent washings.

PLANT INJURY BY CALCIUM ARSENATE

As has been mentioned, if calcium arsenate is properly made, it will not injure the cotton plants. In case any burning or scorching of the leaves is noted, use of this material should cease immediately as a comparatively small amount of leaf burning may easily induce a serious amount of fruit shedding.

AMOUNT REQUIRED PER ACRE FOR EACH APPLICATION

It has been found that with experienced operators handling the machinery, satisfactory results can be secured from the use of about five pounds of calcium arsenate to an acre per application, but it has also been found that with the machinery now available, the new operator will generally average about seven pounds per acre. Consequently, it will be necessary to use this figure in making calculations of consumption. In case of doubt, it is undoubtedly best to make the applications a little excessive rather than too light, because the margin of profit from the operation is generally so large that it is foolish to fisk failure for the sake of saving a small amount of poison.

CONDITIONS UNDER WHICH TO MAKE APPLICATIONS

The weather conditions in which the applications are made are very important indeed in determining their effectiveness, and, consequently, every effort should be made to poison only when the conditions are most favorable. The air should be calm and the plants moist to secure the best results from the applications. This naturally usually means that it is necessary to make the applications at night, although some nights are dry and windy and thus not favorable for the work, while calm, humid days are frequently quite satisfactory.

TIME OF STARTING POISONING

The time of starting poisoning is based practically entirely on the degree of weevil abundance. It is rather difficult to describe a convenient means of determining just when the weevils are becoming actually injurious. In experimental work this generally is based on the percentage of squares which are punctured and where this is feasible it is undoubtedly the best method for the farmer to follow. For this purpose, a hundred squares are examined at different points in the field under consideration and the percentage which is weevil-punctured is noted. Generally speaking, it is

advisable to start poisoning at about 15% to 20% infestationaand to continue often enough to keep the infestation below about 25% or 30% as long as the plants are continuing to set bolls. Where it is not feasible to make counts of this nature, the field should be watched as closely as possible and and poisoning should be started when fallen punctured squares first begin to appear on the ground in some numbers and when the first distorted blooms caused by weevil injury are noted in the field. In case of doubt, it is probably best to start poisoning a little earlier than may be absolutely necessary in order to be on the safe side, although, of course, poisoning should not be started until the plants are large enough to be fruiting rapidly idly and thus in a condition to take most advantage of the comparatively short period of protection.

THE INTERVAL BETWEEN APPLICATIONS

In the past, a time interval of about seven days between applications has been recommended but more recent results indicate that whenever the infestation is at all severe, it is advisable to shorten this interval to not more than four days. By doing this, the control is much greater than with the longer time interval and it is generally found that after about three applications, the weevils are sufficiently well controlled to permit the cessation of poisoning for at least a few weeks and in many cases it has been found that the three applications at the short time interval will so greatly reduce the infestation that the protection will suffice for the remainder of the seasen.

TIME OF STOPPING POISONING

Poisoning should be stopped only when the weevils are thoroughly under control or when the plants have set as much crop as they can mature and these bolls are at least two-thirds grown. It is obviously useless to continue poisoning after the crop of bolls is beyond the danger of weevil attack and the plants have started shedding all new fruit.

THE EFFECT OF RAIN ON APPLICATION

Because of the importance of moisture in weevil control, a certain number of rains are undoubtedly very beneficial to the season's operation. The exact effect of a rain on any particular application must, of course, be gauged by the attendant conditions but it has generally been taken as a rule that when an application is made under favorable conditions which permitta large amount of the poison to adhere to the plants, this application can be considered as successful if twenty-four hours elapse before a heavy drenching rain. In case of a rain within the first twenty-four hours, it is generally advisable to repeat the application immediately.

STARTING POISONING IN THE PRESENCE OF A COMPLETE INFESTATION

Frequently the planter does not decide to poison his cotton until practically all the squares are punctured and it has very nearly stopped blooming. He then desires to secure machinery and to attempt to save his cotton. This is generally not advisable. It should be remembered that in order to

produce more cotton under such conditions, it is necessary not only to control the weevils, but to hold them under control long enough for new squares to form and to develop from the square to the boll stage free from weevil attack. This requires an excessive number of applications of heavy dosages of poison and is not likely to prove profitable under average conditions

In some cases, however, a fair crop of young bolls is set before the weevils overtake square formation and poisoning with a view of protecting these bolls rather than the development of a new crop is frequently quite profitable. This means protection for only a short period and can often be accomplished by only one or two applications.

ORGANIZATION OF POISONING OPERATION

The organization of poisoning work will naturally depend entirely on the size of the property being treated and in view of the newness of the operation it is advisable for this feature to be considered very carefully.

When dealing with large plantations operated on a tenant basis, it may be possible eventually to distribute the poisoning among the individual tenants and rely upon them to attend to it properly, but for the present this method has little chance of success. Consequently, it is advisable under such conditions to maintain a special organization for the poisoning work which makes the applications whenever and wherever they are needed, regardless of tenantry. This is especially advisable in view of the fact that in many districts heavy weevil infestation is found early in the spring only immediately adjoining hibernation quarters, and by controlling the weevils at these initial points of infestation it is possible to prevent their multiplication and later migration to other cotton. Thus the double behefit is derived of protecting both the cuts poisoned and the uninfested adjoining cuts.

On a small farm, it is not possible to utilize this type of organization. The fields are generally small and more uniform distribution of the weevils is found. Under such conditions, it is necessary to poison the entire area and this work must be so planned that it will fit in with the regular operations of the farmer and his laborers.

DUSTING MACHINERY TO USE

The question of dusting machinery is covered in considerable detail in Farmers' Bulletin #1098 of the Department of Agriculture which may be secured free of charge by application to either the Department at Washington or to the Delta Laboratory, Tallulah, La. Consequently, this subject is dealt with only briefly here.

At present, three types of machinery are available: hand guns, power dusters, and wheel traction or cart dusters.

The hand gun is the smallest type of appliance and generally sells at from $15 to $25. Unfortunately, it is very laborious to operate and this

makes tis use on any scale attended with considerable difficulty. A single gun if provided with a rotating crew of about three laborers who can take turns at its operation is capable of handling about fifteen acres of cotton throughout the season, but under normal conditions it is advisable to hold the acreage allotment of a single hand gun as low as possible,-probably not to exceed some ten acres, in order that its operation will not be continuous but will be decidedly intermittent. It is usually found quite unsatisfactory to attempt the poisoning of more than about twenty-five acres of cotton with hand guns, as the labor difficulties are so serious.

The power dusters have been utilized very largely in the past but have proven very undesirable owing to the difficulty of maintenance of the gasoline engine which furnishes the power for the fan and also to the fact that they are rather large and clumsy for convenient operation in the field. On the whole, the delayssin operation experienced with these machines are so serious that it now seems quite probable that they will be entirely supplanted by the wheel traction machines.

The wheel traction machine consists of a two-wheel cart deriving its power entirely from the wheels and is apparently the most satisfactory type now available for large scale poisoning work. Several of these are on the market and it seems probable that their price this season will range from about $200 to $500 each.

For the convenience of those planning to purchase dusting machinery, the following suggestions have been prepared to cover the most important points which should be considered in order to make sure that the machines will will be thoroughly satisfactory.

HAND GUNS

The total weight should be not over twenty pounds when filled with dust

The hopper should be capable of holding about four to seven pounds of calcium arsenate and should be able to put out practically all of this before it is necessary to refill.

The balance of the gun should be such as to cause the least strain on the operator, that is, having the heavy parts of the machine as close to his body as possible.

The gun should hang naturally so that the nozzle is directed at the top of the cotton plants without causing any undue strain on the operator in aiming it.

The capacity of the feeding mechanism should be sufficient to permit the use of a maximum delivery of at least one pound in five minutes at the ordinary rate of cranking.

The feed should be quickly and positively controlled. Adequate facilities should be provided for lubrication of working parts.

The fan should create sufficient air current to break up the dust into a cloud and force it to spread over all parts of the plant.

The gun should be well constructed throughout so that breakage is reduced to a minimum.

All possible parts should be conveniently accessible for repair or replacement.

WHEEL TRACTION OR CART DUSTER

The machine should be light enough in weight and draught to enable an average team to operate it through a full night without undue fatigue.

There should be sufficient axle clearance to avoid plant injury.

The tread should be such that it will straddle a row of cotton, will avoid running on the outside rows and still prevent the machine from being dangerously top heavy.

The machine should be properly balanced on the axle to prevent up-tilting of the tongue or undue strain on the necks of the team.

All details of construction should be simple, fool-proof and durable.

The feed mechanism should be subject to quick and positive regulation varying from a complete cut-off to a maximum delivery of six pounds in five minutes through the three nozzles at ordinary rate of walking for the team.

The fan should create sufficient air blast to prevent clogging in the pipes and to blow the dust throughout the plants under any weather conditions where dusting would ordinarily be attempted.

The machines should be provided with suitable lighting equipment.

The hopper capacity should be sufficient to hold from thirty to fifty pounds of calcium arsenate.

The distributing system should be provided with a positive lift to regulate the height of the nozzles from vertical to horizontal and should also be conveniently folded for the purpose of permitting passage through gates.

The platform should be large enough to accommodate all machinery and the driver and also to carry a barrel of dust.

The driving mechanism should be so arranged that the fan will continue in operation while the machine is turning on one wheel in either direction at row ends.

The running and driving mechanism should be shielded to prevent plant injury or clogging with vegetation.

The method of hitching should allow flexibility which will prevent the

load being thrown on one animal.

All parts should be readily accessible for repair or replacement.

POWER DUSTER

A careful study of the requirements of the cart duster should enable anyone to see what should be expected of a power machine. The only points requiring further attention are those in which the two types of machines differ in construction, the principal points of difference being the engine, truck and distributor.

The engine should be as simple and efficient a type as possible and should provide a slight surplus of power over that actually required to operate the machinery.

The truck should be provided with a fifth wheel arrangement and the front wheels should cut under the body to permit short turns.

The distributor construction should be strong enough to carry the spread of nozzles.

COST OF POISONING AND GAINS TO BE EXPECTED

The cost of the operation and the gain to be expected is entirely dependent upon the conditions existing in any particular field. It has been found that the season's operation on heavily infested cotton usually costs from seven to ten dollars per acre. This, of course, applies to the area which is all poisoned throughout the season. The cost for materials and machinery is, of course, distributed over a larger area when the operation is conducted on a large plantation basis and only a part of the crop poisoned for the protection of the remainder, but in this case the more complicated organization required is decidedly more expensive to maintain so that the total cost is probably much more in the end.

It seems quite probable that with further experience in poisoning, it will be possible to adapt this method to even the unfertile soils, but for the present the cost is so high and the possibilities of error in its use so great that it seems inadvisable to attempt poisoning on land which is not capable of making at least half a bale of cotton per acre in the absence of weevil injury.

The gain secured under different conditions in carefully checked experimental plats have ranged as high as 1,000 pounds of seed cotton per acre and undoubtedly this amount has been exceeded in some of the large scale work. It seems safe to assume that in fairly fertile soil subject to serious degree of weevil injury average gains of from 300 to 500 pounds of seed cotton per acre are quite possible.

Anyone contemplating poisoning should remember that this is a serious, complicated and more or less laborious operation, and, furthermore, its ex-

pense is so great that it should be undertaken only when there is at least reasonable assurance of its being handled properly. Haphazard applications will not yield successful results and the Department's advice is that when the grower is in any doubt whatever of being able to give the operation the attention it requires, he should not attempt it. With more experience in the different districts, weevil poisoning will become more or less routine and will be handled just as are the other operations of the farm, but it is so complicated and so new that it cannot be conducted on this basis at present.

Firms Considering Manufacture of Cotton Dusting Machinery in 1920.

Niagra Sprayer Co.,
Middleport, N. Y.
Vicksburg, Miss.

Feeny Mfg. Co.,
Muncie, Ind.

Leggett & Bro.,
#301 Pearl St.,
New York City.

W.N. Mathews & Bro, Inc.,
St. Louis, Mo.

Hardie Mfg. Co.,
Hudson, Mich.

B. F. Avery & Sons,
Louisville, Ky.

Ward Pump Co.,
Rockford, Ill.

Babcock Mfg. Co.,
Leonardsville, N.Y.

Dust Sprayer Co.,
1222-4 West 9th St.,
Kansas City, Mo.

Springfield Dry Powder Sprayer Co.,
Springfield, Tenn.

Friend Mfg. Co.,
Gasport, Niagara Co., N.Y.

Bateman Mfg. Co.,
Grenloch, N. J.

Field Force Pump Co.,
Elmira, N. Y.

Kentucky Wagon Mfg. Co.,
Louisville, Ky.

Albert Lea Sprayer Co.,
Albert Lea, Minn.

Firms Planning to Produce Calcium Arsenate in 1920.

Riches, Piver & Co.,
#30 Church St.,
New York City

Sales Office: Vicksburg, Miss.

General Chemical Co.,
#25 Broad St.,
New York City.

Sales Office: Ferry & Wabash Track
St. Louis, Mo.

Grasselli Chemical Co.,
Cleveland Ohio.

Sales Office: "301 Godchaux Bldg.,
New Orleans, La.

Toledo Rex Spray Co.,
Toledo, Ohio.

The Sherwin-Williams Co.,
Plant No. 2, Pullman Station,
Chicago, Ills.

Sales Offices: #601 Canal Road, N.W.
Cleveland, Ohio

Second & Clinton Sts
St. Louis, Mo.

Corona Chemical Co.,
Milwaukee, Wis.

1801 Wall St.,
Dallas, Texas.

Devoe & Reynolds.,
14-16 W. Lake St.,
Chicago, Ills.

2108 Preston Ave.,
Houston, Texas.

#317 Camp St.,
New Orleans, La.

Stratford Chemical Co.,
Morganville, N.J.

Niagara Sprayer Co.
Middleport, N.Y.

Sales Office: First National Bank Bldg.,
Vicksburg, Miss.

Interstate Chemical Co.,
12-20 Bayview Ave.,
Jersey City, J. J.

Merrimac Chemical Co.,
#148 State St.,
Boston Mass.

The Agricultural Chemical Co.,
#1131 W. Chicago Ave.,
Chicago, Ill.

Ansbacher Insecticide Co.,
#527 - 5th Avenue,
New York City

The Glidden Company,
Cleveland, Ohio.

Dow Chemical Company
Midland, Mich.

Hemingway & Co. Inc.,
Bound Brook, N. J.

Latimer-Goodwin Chemical Co.,
Grand Junction, Colorado.

Standard Chemical Co.,
Reading, Pa.

The Kil-Tone Co.,
Vineland, N. J.

Nitrate Agencies Co.,
#85 Water Street,
New York City.

Sales Offices: Canal Commercial Bank Bldg.,
New Orleans, La.
Savannah Bank & Trust Bldg.,
Savannah, Ga.

Niasco Chemical Co.,
New Market, N. J.

(Co.,
U.S. Smelting, Refining & Mining/
Salt Lake City, Utah.

Virginia-Carolina Chemical Co., Richmond, Va., Sales Office: Atlanta, Ga.

J.A. Blanchard Chemical, Co.,
#30 Church St., New York City.

Imperial Chemical Co.,
Grand Rapids, Mich.

California Spray Chemical Co.,
Watsonville, Calif.

Bowker Insecticide Co.,
Boston, Mass.

Anaconda Copper Mining Co.,
Anaconda, Montana.